



MARSHALL STAR

Serving the Marshall Space Flight Center Community

March 31, 2011

Busy day in Huntsville for NASA administrator



NASA Administrator Charles Bolden visited Huntsville March 24 to speak at a variety of functions, including a news conference with Huntsville-area media at the U.S. Space & Rocket Center, above left; and a Marshall Space Flight Center all-hands meeting, above right, where he and Marshall Center Director Robert Lightfoot briefed



team members on the latest news from Washington. Bolden also met with U.S. Space Camp students and participated in the Marshall Space Business Alliance meeting at the Davidson Center for Space Exploration, where he presented the NASA Small Business Administrator's Cup award to the Marshall Center. Read more about it below.

NASA's successful 'can crush' will aid heavy-lift rocket design

By Jennifer Stanfield

NASA put the squeeze on a large rocket test section March 23. Results from this structural strength test at the Marshall Space Flight Center will help future heavy-lift launch vehicles weigh less and reduce development costs.

This trailblazing project is examining the safety margins needed in the design of future, large launch vehicle structures. Test results will be used to develop and validate structural analysis models and generate new "shell-buckling knockdown factors" – complex engineering design standards essential to launch vehicle design.

*See **Crush** on page 5*

Marshall earns NASA's Small Business Administrator's Cup award – twice in three years

By Rick Smith

On March 24, NASA Administrator Charles Bolden presented the agency's Small Business Administrator's Cup Award for fiscal year 2010 to the Marshall Space Flight Center.

It's the second time in three years Marshall has earned the accolade, which is given annually to the NASA center that has demonstrated the most successful and

*See **Award** on page 6*

Director's Corner

MSFC's successful spring

I know we've been going through some trying times lately, and we still have challenges ahead. With the recent spring weather, though, came several reminders that the seeds this nation planted at Marshall 50 years ago continue to bear fruit.

Just last week, in Building 4619, our Structural Strength Test Branch successfully conducted a data-rich test that's going to change the way we and the whole launch vehicle industry design rockets. Since this country's been designing rockets, we've been adding a margin of safety to the outer walls and propellant tanks to keep them from buckling. Those safety margins date to the early days of spaceflight. With new materials and new computer aided design tools, it was time to update those so-called "knockdown factors."

For this test, we put more than 800,000 pounds of force on an aluminum lithium tank section 27.5 feet in diameter and 20 feet tall. That's the kind of big time rocket engineering we're known for.

Based on this test and others leading up to it, it looks like we can shave several thousand pounds off our rockets, weight that can be devoted instead to useful payloads like habitats, rovers, and robotic probes.

We hosted some special guests who came to watch the test live, including representatives of United Launch Alliance, Blue Origin, SpaceX, and Aerospace Corp. Data like this makes everyone more competitive and space launch more affordable.

The test was a classic NASA team effort. The NASA Engineering and Safety Center based at Langley Research Center sponsored and funded the tests. Lockheed Martin Space Systems fabricated the test article at Marshall's Advanced Weld Process Development Facility. Marshall's Structural Strength Test

branch was responsible for the test, including engineering, equipment design, hardware, facilities, and safety assurance.



Robert Lightfoot

That same day, Marshall Center Chief Technologist Andrew Keys was on CNN, talking about a new Marshall medical spinoff, a light technology developed for space plant growth experiments that also can mitigate the unpleasant side effects of radiation and chemotherapy for cancer patients. If you tuned in, you saw that Andrew shared the news studio with a medical devices company representative and a professor from University of Alabama Birmingham.

Also last week, NASA Administrator Charlie Bolden was here to present us with the award for the best small business program in the agency. In the process, we set a record last year for contract awards to small business prime contractors.

Common to all three efforts in just one week were collaboration, partnership, and stimulating small business – all key goals for NASA in the next few years. They have been recurring themes this spring.

On March 3, our engineers began integrated system tests on a new robotic lander prototype at the Redstone Test Center's propulsion test facility on the Army side of Redstone Arsenal. This work brings together engineers from Marshall, the Army and support contractor Teledyne Brown Engineering. They modified a historic missile test stand in record time. The prototype was designed, built and partly tested in just 17 months by a team from Marshall, Johns Hopkins Applied Physics Laboratory in Maryland, and the Von Braun Center for Science and Innovation in Huntsville.

On March 9, the last flight of Space Shuttle Discovery ended with the call "Wheels stop." And then Mission

Control said, "No post-flight deltas." That meant the orbiter was in perfect shape. It also meant Marshall and its industry team had hammered flat a pre-flight problem with the External Tank stringers to continue our journey to a successful finish for the Shuttle Program.

On March 17, NASA's Messenger spacecraft became the first satellite to orbit Mercury after a journey of more than six years and 96 million miles. Marshall manages the Discovery and New Frontiers Program that includes Messenger. The Johns Hopkins Applied Physics Laboratory manages the project and built and operates the craft. NASA's Goddard and Kennedy field centers are part of a broad team of agencies, institutions, and companies that played a role in the instruments, the spacecraft, and the mission.

Looking ahead, we're getting ready to test the 18 gold-coated flight mirrors for the James Webb Space Telescope in our X-Ray Calibration Facility as part of a partnership between Northrop Grumman, Ball Aerospace, Goddard Space Flight Center, and ourselves.

Down at Stennis Space Center, Pratt & Whitney Rocketdyne is putting together the first development J-2X upper stage engine for testing.

In education, another NASA priority, we're getting ready for the Great Moonbuggy Race and the Space Launch Initiative rocket launches at Bragg Farm, two of NASA's premier efforts to encourage students to study math and science.

It's amazing how many times in such a short period that NASA's major themes of collaboration, partnership, encouraging small business, and education appear in Marshall's work this year. No team in the world does those things better than the Marshall Team. Thanks for – literally – all that you do for the space program and the nation.

Robert Lightfoot
Marshall Center Director

Marshall invited to join Apollo-era veterans, Moonbuggy Race students for April 1 celebration marking 40 years since first rover rolled on moon

By Rick Smith

The 18th annual NASA Great Moonbuggy Race, which begins April 1 at the U.S. Space & Rocket Center, commemorates the 40th anniversary of the first use of the Lunar Roving Vehicle on the moon – and the Marshall Space Flight Center team is invited to a special event that evening to help celebrate that unprecedented historic feat.

They'll be among esteemed company. Apollo astronauts Charles Duke and Harrison "Jack" Schmitt will take part in the event, along with retired Marshall project manager Saverio "Sonny" Morea and approximately 80 other Marshall, Boeing, Northrop Grumman and General Motors engineers who worked on the original program. More than 300 moonbuggy racers also will participate, mingling with the men and women whose ingenuity and determination helped to inspire the popular student competition.

The celebration is set for 7 p.m. in the main hall of the Davidson Center for Space Exploration at the U.S. Space & Rocket Center, under the massive, suspended Saturn V rocket. It will include remarks by Duke, Schmitt, Morea, Marshall engineer Ron Creel, Boeing engineer Gene Cowart, General Motors engineer Sam Romano and retired NASA manager George Mueller, who was associate administrator of NASA's Office of Manned Space Flight from 1963-1969. A special, 11-minute film about the Lunar Roving Vehicle, called "Moon Machines," and a moderated question-and-answer session will follow.

Attendance at the celebration is free for all Marshall team members. It is hosted by the Marshall Center, the American Institute of Aeronautics & Astronautics and the U.S. Space & Rocket Center. The event is sponsored by AIAA and the Huntsville operations of Northrop Grumman, The Boeing Company and Lockheed Martin.

In just 17 months between 1969-1971, the NASA-industry team finalized the Lunar Roving Vehicle's design, built and tested it at Marshall and partner facilities and sent it to the moon as a key element of the Apollo 15 mission. There, for three days beginning July 31, 1971, astronauts David Scott and James Irwin put the rover through its flawless paces, dramatically expanding their scope of exploration on the lunar surface.

Two more "moonbuggies" followed in 1972, enabling still greater scientific expeditions during the Apollo 16 and Apollo 17 missions. To learn more about the Lunar Roving Vehicle program, visit <http://history.nasa.gov/alsj/MSFC-LRV.pdf>.

Smith, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis & Communications.



NASA astronaut James Irwin, the lunar module pilot during the Apollo 15 mission, works on the Lunar Roving Vehicle during his first extravehicular activity on the moon on July 31, 1971.

NASA Great Moonbuggy Race set for April 1-2 at Space & Rocket Center

The 18th annual NASA Great Moonbuggy Race will be held April 1-2 at the U.S. Space & Rocket Center in Huntsville. Marshall Space Flight Center team members and their families are encouraged to come out and cheer for more than 80 national and international teams competing in the race. Admission is free.

The race challenges high school and college students to design, build and race lightweight, human-powered rovers – "moonbuggies" – which address many of the same engineering challenges dealt with by Apollo-era lunar rover developers at the Marshall Center in the late 1960s.

The race is organized each year by Marshall's Academic Affairs Office. This year's event marks the 40th anniversary of the first use of the Lunar Roving Vehicle on the moon during the Apollo 15 mission in July 1971.

Web users can watch the first day of racing live on UStream at <http://www.ustream.tv/channel/nasa-msfc>. For more race information, visit <http://www.nasa.gov/topics/moonmars/moonbuggy.html>.

Return to Flight missions: Increasing shuttle safety

Editor's Note: STS-1 lifted off April 12, 1981, marking the first launch of a reusable spacecraft. Space shuttles have repeatedly carried people into orbit; launched, recovered and repaired satellites; conducted cutting-edge research, and built the largest structure in space, the International Space Station. As the program nears its 30th anniversary, the Marshall Star is featuring highlights from past shuttle missions.

By Sanda Martel

NASA returned space shuttles to flight with the STS-114 mission in July 2005, but Return to Flight was more than a single mission. It illustrated NASA's ability to learn from mistakes and its determination to prevent new ones. It also paid tribute to a crew of seven brave space shuttle Columbia astronauts who gave their lives in the pursuit of the knowledge that comes from exploration.

Following the Columbia accident on Feb. 1, 2003, the independent Columbia Accident Investigation Board conducted a thorough, seven-month inquiry and issued its findings and recommendations in a comprehensive report in August 2003. The board determined that the physical cause of the accident was a breach in the shuttle's left-wing leading edge caused by a piece of insulating foam that fell off the external tank during the climb to orbit.

STS-114: Returning the space shuttle to flight

Space shuttle Discovery launched on the STS-114 mission July 26, 2005, after two-and-a-half years were spent researching and implementing safety improvements, including an in-depth redesign and refitting of external tanks to reduce the risk of foam and ice hitting the orbiter during liftoff.

Although emphasis was placed on external tank improvements and modifications, time also was devoted to testing, analyzing and making

improvements on the main engines and reusable solid rocket boosters and motors. Those propulsion elements are all managed by the Marshall Space Flight Center.

Discovery's climb to orbit was extensively documented through a system of new and upgraded ground-based cameras, radar systems and cameras aboard high-altitude aircraft. Three cameras – one on the external tank and one on each of the two solid rocket boosters – flew on the space shuttle as it returned to flight on STS-114. This enhanced imagery helped mission managers determine the health of Discovery's thermal protection system.

Because of foam loss from the external tank during launch, teams took one year to review foam performance and determine the likely causes.

STS-121 – the next step

Shuttle Discovery provided spectacular fireworks when it launched July 4, 2006, on STS-121. Discovery's crew continued to test new equipment and procedures that debuted on STS-114 and built upon those tests, including an external tank redesign and new processes to minimize potentially damaging debris during launch.

Discovery's external tank on the STS-121 mission was the first to fly without the nearly 40-pound protuberance airload ramps. The Space Shuttle Program determined that foam lost from the external tank during the STS-114 mission from these foam ramps could safely be removed from the tank. A Marshall-developed experimental space shuttle wing repair material made its second flight to orbit. Dubbed "NOAX," for non-oxide adhesive experiment, the repair technique was successfully tested on STS-114 in the cargo bay of shuttle Discovery. The paste-like sealant is capable of repairing small damage to the shuttle's reinforced carbon carbon wing.

STS-121 was the most photographed shuttle mission in history, with more than

100 high-definition, digital, video and film cameras documenting the launch and climb to orbit. The images helped assess any damage sustained and potential risk for landing. The crew used the orbiter boom sensor system with a laser dynamic range imager, laser camera system and intensified television camera on the end, to examine the shuttle's nose cap, port wing, leading edge of the starboard wing, and outside of the crew cabin. No risk was found.

Following these two Return to Flight missions, the pace to complete assembly of the International Space Station accelerated. Deliveries of the integrated truss structure, which forms the backbone of the space station, continued with the STS-115 mission in September 2006, STS-116 in December 2006, STS-117 in June 2007 and STS-118 in August 2007.

Further outfitting of the space station continued with the following deliveries by space shuttle missions:

- STS-120 in October-November 2007: Node 2 Harmony module, which increased living and working space.
- STS 122 in February 2008: European Space Agency's Columbus Laboratory, which provides research facilities.
- STS-123 in March 2008: Japanese Pressurized Logistics Module, used to store maintenance and experiment materials and spare parts.
- STS-124 in May-June 2008: Kibo Japanese Experiment Module, which improves the unique research capabilities of the space station.
- STS-119 in March 2009: S6 Truss segment to complete the 361-foot-long backbone of the station and the final set of solar arrays to generate power.
- STS-127 in July 2009: Japanese Exposed Experiment facility, a "porch" attached outside the space station for science

See Safety on page 8

"This type of research is critical to NASA developing a new heavy-lift vehicle," said NASA Administrator Charlie Bolden. "The Authorization Act of 2010 gave us direction to take the nation beyond low-Earth orbit, but it is the work of our dedicated team of engineers and researchers that will make future NASA exploration missions a reality."

The aerospace industry's shell buckling knockdown factors date back to Apollo-era studies when current materials, manufacturing processes and high-fidelity computer modeling did not exist. These new analyses will update essential design factors and calculations that are a significant performance and safety driver in designing large structures like the main fuel tank of a future heavy-lift launch vehicle.

During the test, a massive 27.5-foot-diameter and 20-foot-tall aluminum-lithium test cylinder received almost one million pounds of force until it failed. More than 800 sensors measured strain and local deformations. In addition, advanced optical measurement techniques were used to monitor tiny deformations over the entire outer surface of the test article.

The Shell Buckling Knockdown Factor Project is led by engineers at NASA's Engineering and Safety Center – NESC – and NASA's Langley Research Center in Hampton, Va. NASA's heavy-lift space launch system will be developed and managed at Marshall.

"Launch vehicles are thin walled, cylindrical structures and buckling is one of the primary failure modes," said Mark Hilburger, a senior research engineer in the Structural Mechanics and Concepts Branch at Langley



Mark Hilburger, left, senior research engineer in the Structural Mechanics and Concepts Branch at Langley and the principal investigator of NASA's Engineering and Safety Center Shell Buckling Knockdown Factor project, and Mike Roberts, an engineer in Marshall's Structural Strength Test Branch and the center lead for this activity, review test data in the control room in Marshall's Building 4619.

and the principal investigator of the NESC's Shell Buckling Knockdown Factor project. "Only by studying the fundamental physics of buckling through careful testing and analysis can we confidently apply the new knowledge to updated design factors. The outcome will be safer, lighter, more efficient launch vehicles."

Leading up to this full-scale test, the shell buckling team tested four, 8-foot-diameter aluminum-lithium cylinders. Current research suggests applying the new design factors and incorporating new technology could reduce the weight of large heavy-lift launch vehicles by as much as 20 percent.

"Marshall's Structural and Dynamics Engineering Test laboratory is uniquely suited for shell buckling testing," said Mike Roberts, an engineer in Marshall's Structural Strength Test Branch and the center lead for this activity. "Originally built to test Saturn rocket stages, the capabilities found here were essential to developing the lightweight space

shuttle external tank flying today and for testing International Space Station modules."

For this test, Marshall led all test operations including the engineering, test equipment design and safety assurance. Lockheed Martin Space Systems Company fabricated the test article at Marshall's Advanced Weld Process Development Facility using state-of-the-art welding and inspection techniques. Langley engineers led the design and analysis of the test articles, defined the test requirements, and developed new optical displacement measurement standards that enabled highly accurate assessment of the large-scale test article response during the test.

In the future, the shell buckling team will test carbon-fiber composite structures that are 20-30 percent lighter than aluminum and widely used in the automotive and aerospace industries.

Stanfield is a public affairs officer in the Office of Strategic Analysis & Communications.

Award *Continued from page 1*

effective small business program. The Marshall Center previously received the Small Business Administrator's Cup for fiscal year 2008, the year the award was created.

Bolden and Glenn Delgado, assistant administrator of NASA's Office of Small Business Programs in Washington, presented the honor to Marshall Center Director Robert Lightfoot and Marshall small business specialist David Brock.

The award presentation was held during the Marshall Small Business Alliance's meeting at the U.S. Space & Rocket Center's Davidson Center for Space Exploration. The quarterly event provides networking opportunities and encouragement for businesses to compete for procurement and subcontracting opportunities.

"Small business is crucial not only to NASA, but to the nation," Bolden said. "Federal procurement opportunities for women, minority and veteran-owned small businesses are critical to the economy and to sustaining economic development.

Marshall's commitment to the small business community, along with its broad and diverse portfolio, is why the center is being recognized."

"I am extremely proud of the Marshall small business team, and its dedication to nurturing the small business partners and enterprises that are key to the success of our programs and projects," Lightfoot said. "To be recognized twice in three years for that dedication reflects the strength of our small business program, and our commitment to creating and maintaining the kind of mutually rewarding partnerships that will carry on NASA's mission into the next era of space exploration and discovery."

Sponsored by the NASA Office of Small Business Programs, the award recognizes the winning center's implementation of successful, innovative practices that promote the participation of small businesses in helping NASA achieve its mission. It also honors the significant contributions of that center's senior management, procurement office and program and technical personnel to the agency's small business programs.

When the Marshall Center first received the Administrator's Cup, it had just celebrated the Marshall Small Business Alliance's first year of operation. The alliance, a regional conduit to help small businesses pursue NASA procurement and subcontracting opportunities, has since established itself as a vital resource for thousands of small businesses.

"Our successes start with our management. Their continuing support has created a positive environment in which to promote small business utilization across all organizations at

the Marshall Center," said David Brock, who organized the Small Business Alliance. Last December, he received the NASA Small Business Specialist of the Year award for fiscal 2010.

Brock also credits Marshall's large business prime contractors, which helped provide approximately \$435 million in total subcontracting awards to small businesses in fiscal 2010, and two center organizations: the Marshall Prime Contractor Supplier Council, which includes representatives of 45 large businesses; and the Marshall Small Business Executive Leadership Team, comprised of representatives of 27 small businesses.

"The key is teamwork," he said.

For more information about the NASA Small Business Administrator's Cup Award and NASA's Office of Small Business Programs, visit <http://www.osbp.nasa.gov>.

Smith, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis & Communications.



Showing off the NASA Small Business Administrator's Cup award are, from left, Glenn Delgado, assistant administrator of NASA's Office of Small Business Programs in Washington; Byron Butler, director of the Marshall Center's Office of Procurement; David Brock, Marshall small business specialist; NASA Administrator Charles Bolden; and Marshall Center Director Robert Lightfoot.

Systems and Software Engineering Forum set for May 10-11

The Marshall Space Flight Center will host the third annual Systems and Software Engineering Forum from 8:30 a.m. to 5 p.m. May 10-11 at the University of Alabama in Huntsville's Shelby Center.

The forum – themed "Acquisition of System Integrations and Software Products" – will feature local, national and international subject-matter experts from government, industry, research and academia. They will discuss such topics as the challenges in disciplines of

systems and software engineering; real-world solutions and examples; and the opportunities for networking and collaborations.

Registration is \$145. For more information – including how to register and a list of participating organizations – see the flyer on ExplorNet at <https://explornet.msfc.nasa.gov/docs/DOC-2718>.

For questions, contact Tim Crumbley, forum chairman, at 544-5978.

Classified Ads

To submit a classified ad to the Marshall Star, go to Inside Marshall, to "Employee Resources," and click on "Marshall Star Ad Form." Ads are limited to 15 words, including contact numbers. No sales pitches. Deadline for the next issue, April 7, is 4:30 p.m. Thursday, March 31.

Miscellaneous

Three-piece glass-top table set, coffee and two end tables, make offer. 256-684-2606

Hard plastic, open-face badge holders, \$3.50 each. 256-348-4139

Permobil C300 power-wheelchair, tilt, recline, leg lift, raises, \$3,200. 256-778-8893 call between 5-7 p.m.

DCI Titleist irons, steel/regular shafts, 3-PW, plus SW and LW, \$225. 256-881-5642

Custom Playa rims, \$1,000 obo. 256-509-6482

Solid oak queen sleigh bed, pictures at <http://knology.net/savagmf/>, \$650. 256-883-7752

Two tickets to WWE Raw World Tour at VBC, June 3, 7:30 p.m., \$70 obo. 256-431-8665

Woods End bunk bed, mattresses, ladder and storage drawer, honey oak finish, \$250. 256-539-5308

Colt Python .357, early 1980s Model, blue, 6-inch barrel, \$1,500 firm. 256-830-5663

Solid oak pedestal table, six chairs, \$500. 256-683-8823

Home entertainment center, two piece, solid wood construction, \$200. 256-617-3334

Antique mahogany coffee table, Italian marble top, \$100; stamp collection, \$100. 351-1754

Maytag dryer, gas powered, white, \$60. 256-394-2599

Six floating geese decoys, \$40; bronze storm door/frame, \$40; Eagle Transducer HS-WST, \$20. 256-527-0110

Bicycle work stand, \$25. 256-881-4028

Antique curved telephone table with light fixture, picture available, \$150. 256-882-3895

Two tickets for Talladega Arrons 312 and 499, Tri-Oval Tower, reserved camping spot, \$450. 256-679-2165

Pulaski Furniture dining set, table, six chairs, buffet table, \$1,300 obo. 256-652-2241

Two tickets to BTL "Burn the Floor," 8 p.m. April 2, Row J, seats 4&5. 256-503-7060

Graco high chair, Birkshire, \$45; Baby Einstein stationary entertainer, \$40; tandem double stroller, \$30. 256-895-2959

Peavey Zodiac bass, \$225; Fender Rmb100 bass amp, \$175; Samson MDR8 24-bit mixer, \$150. 256-883-8632

Emperador 12-string acoustic guitar, no case, \$100. 256-520-2062

Foxconn Nettop PC, Atom D510, 1.66 dual core, 2GB ram, 320GB HD, Ubuntu OS, \$175. 256-457-5823

Yamaha VMAX propeller, 15 1/8 25 in diameter, new hub,

\$325. 256-975-9325

Vehicles

2010 Camaro LS, white, 8k miles, will take payoff. 256-797-3123

2008 18-ft pontoon boat, \$15,000. 256-301-9592

2008 navy blue Solstice, five speed, A/C, prem audio, 19,900 miles, \$19,000. 256-682-1573

2007 Mazda3 iTouring 4D sedan, 67k miles, \$10,500. 256-698-1568

2006 Kawasaki Ninja 650R, \$3,000. 256-233-8598

2005 Toyota Sequoia, 2WD, gold, leather, loaded, 100k miles, \$18,000. 256-233-5533

2003 Toyota Sequoia Limited 2WD, 4.7L V8, white, gray leather, tilt/slide moonroof, 128k miles, \$13,500. 256-655-3065

2000 Lincoln LS, V6 3.8 engine, 158k miles, \$4,000 obo. 256-457-9709

2000 Corvette, pewter metallic, black leather, six speed, loaded, 116k miles, \$16,000. 256-614-0707

Fiberglass fishing boat, 80hp Mariner, trailer, trolling motor, depth finder, \$2,650 obo. 256-651-3655

Found

Set of Jeep keys, Tiros and Martin Road, March 23; silver earring, bench behind Building 4200, March 22. 256-544-4680

THE FACE OF MISSION SUCCESS IS: Elizabeth Esther

*Aerospace engineer
in the Advanced Concepts Office*

- **Organization:** Engineering Directorate
- **Joined NASA:** 2008
- **Education:** Bachelor's degree in aerospace engineering, Auburn University, 2008.
- **Responsibilities:** My responsibilities include working on the conceptual design of in-space and Earth-to-orbit systems with concentration on vehicle sizing and configuration, structural analysis and trajectory. I currently am working on a design that will use existing assets to gain access to orbits of interest for future endeavors in support of the Exploration Systems Mission Directorate's capability-driven framework.
- **How do you hope to contribute to Marshall Space Flight Center's future goals?** By being committed to learning and growing to be able to someday bring a



new and valuable perspective to the Marshall team as we get to explore and discover the universe around us.

What is something people would be surprised to find out about you? I am a member of North Carolina's Gaston County Debutante Club and have the charm bracelet to boot.

- **Who is someone you admire and why?** Blessed Teresa of Calcutta – formerly Mother Teresa. She did not see obstacles, only love and people. She stepped out in faith and made history.

Safety

Continued from page 4

- experiments that require a dose of hard vacuum or radiation.
- STS-130 in February 2010: Node 3 Tranquility module, a room for crew members and many of the space station's life support and environmental control systems already on board; and Cupola, an observation deck.
 - STS-132 in May 2010: Rassvet

Russian Mini Research Module, for science research and cargo storage.

- STS-133 in February 2011: Permanent Multipurpose Module, originally the Italian-built Leonardo module, will provide additional crew storage space and room for experiments.

Other shuttle missions to the space station delivered cargo and supplies,

experiment facilities and additional solar arrays. More than one-half of the elements required to complete assembly of the space station were delivered after the two Return to Flight missions. With the STS-133 deliveries and installation, the assembly of the orbiting facility is complete.

Martel, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis and Communications.

MARSHALL STAR

Vol. 51/No. 28

Marshall Space Flight Center, Alabama 35812
256-544-0030
<http://www.nasa.gov/centers/marshall>

The Marshall Star is published every Thursday by the Public and Employee Communications Office at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration. Classified ads must be submitted no later than 4:30 p.m. Thursday to the Marshall Public and Employee Communications Office (CS20), Bldg. 4200, Room 102. Submissions should be written legibly and include the originator's name. Send e-mail submissions to: MSFC-INTERCOM@mail.nasa.gov. The Star does not publish commercial advertising of any kind.

Manager of Public and Employee
Communications: Dom Amatore
Editor: Jessica Wallace Eagan

U.S. Government Printing Office 2011-723-031-00092

www.nasa.gov

PRE-SORT STANDARD
Postage & Fees PAID
NASA
Permit No. 298